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(54) IMPROVEMENTS IN OR RELATING TO ELECTRICALLY HEATED VESSELS

(71) We, BRITISH DOMESTIC APPLIANCES LIMITED, of Peterborough a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to electrically heated domestic vessels such as jugs, kettles, pans, percolators and the like which are used for boiling water and other liquids and which are provided with an electric immersion heater controlled by at least one thermally operated device. Such a thermally operated device may be arranged to operate if the vessel boils dry or if the vessel is switched on without any liquid in it, or may be arranged to be operated by steam produced when liquid in the vessel boils.

In some electrically heated vessels as proposed hitherto the thermally operated device and the electrical connections between it and the immersion heater within the vessel are usually accommodated in a housing mounted on the vessel, with the result that the housing and many of the electrical conductors and components therein may have to be dismantled or removed when the electrical circuit and components require adjustment or repair. Consequently, a vessel which develops an electrical fault may have to be returned to the manufacturer because the retailer does not have the technical skill to effect the necessary adjustment or repair.

An object of the invention is to provide an electrically heated domestic vessel which alleviates the above difficulty.

According to one aspect of the present invention an electrically heated domestic vessel comprises a first housing mounted in a wall of the vessel and supporting an

electric immersion heater so that it extends into the vessel, this first housing carrying a first thermally operated device arranged to operate if the vessel boils dry or is switched on without any liquid in it, a second housing mounted on a wall of the vessel and accommodating a second thermally operated device arranged to be operated by steam produced when liquid in the vessel boils and when operated to actuate switch contacts controlling an energising circuit of the immersion heater, and co-operating electrical conductors carried by the two housings and arranged to make electrical contact and automatically establish an electrical circuit between electrical components supported by or accommodated in the two housings when the two housings are attached to the vessel, the first thermally operated device being arranged to break an electrical contact between the co-operating conductors when it operates.

The switch contacts actuated by the second thermally operated device can be set to a first condition such that the energising circuit of the immersion heater is restored automatically when the liquid in the vessel stops boiling and the second thermally operated device cools down. Therefore, once the liquid in the vessel has boiled the immersion heater is thereafter energised intermittently so as to allow the contents of the vessel to simmer.

Alternatively, the switch contacts actuated by the second thermally operated device can be set to a second condition such that once the energising circuit of the immersion heater has been broken by the switch contacts it cannot be restored until the switch contacts have been reset manually.

Steam from the upper part of the vessel may be conveyed to a thermally responsive

part of the second thermally operated device by way of an aperture in the wall of the vessel which leads to a compartment defined between that wall and the second housing. A duct communicating with this aperture may be provided in the wall of the vessel and may be formed with a plurality of outlets arranged so that steam is directed onto substantially the whole of the thermally responsive part. Alternatively, steam may be conveyed to the thermally responsive part of the second thermally operated device by way of a tube extending between the upper part of the vessel and a compartment in which the thermally responsive part of the thermally operated device is housed.

Preferably, each of the housings is arranged so that it can be detached from the vessel without disturbing the other housing.

Each of the housings may carry a terminal pin through which energising current can be supplied to the immersion heater, and the parts of the two housings carrying the terminal pins may be arranged to co-operate with a shroud member carried by the second housing and surrounding the terminal pins to provide a terminal pin assembly for receiving a connector for connecting the vessel to an electrical supply. The shroud member may be secured to the second housing by a screw and may have to be removed from the vessel before the first housing can be detached from the vessel.

The second housing may be arranged to form a handle for carrying the vessel. When the vessel is a jug the second housing may be secured to a substantially vertically disposed wall of the jug. When the vessel is a kettle the second housing may be secured to a substantially horizontally disposed upper wall of the kettle.

The second housing may be arranged to co-operate with the wall of the vessel on which it is mounted to define between them a compartment in which a thermally responsive part of the thermally operated device is housed.

With embodiments of the invention as defined above, repair of an electrical fault can be carried out by replacing the relevant one, or in extreme cases both, of the housings. Preferably the housings are secured to the vessel by screws, so that repair of a faulty electrical circuit can be effected by a retailer using only a screwdriver and a supply of serviceable housings.

The invention will now be described, by way of example, with reference to the drawings filed with the Provisional Specification in which:—

Figure 1 is a side elevation of an electrically heated jug embodying the invention;
Figure 2 is a rear elevation of the electrically heated jug shown in Figure 1;

Figure 3 is a sectional elevation taken on

the line III—III in Figure 2 but drawn to a larger scale than that Figure;

Figure 4 is a fragmentary sectional elevation taken on the line IV—IV in Figure 2 but drawn to a larger scale than that Figure;

Figure 5 is a perspective view of a snap action switch shown in Figure 3;

Figure 6 is a perspective view of a cover shown in Figure 3; and

Figure 7 is a fragmentary sectional elevation of a modified form of a compartment and thermally operated device shown in Figure 3.

Referring in the first instance to Figures 1 to 6, the electrically heated jug comprises a cylindrical body 1 with a pouring lip 2 and a detachable lid 3. The body 1 is supported on three feet 4 and is provided with a handle 5 of electrically insulating material such as asbestos filled phenolic resin. A sheathed wire heating element 6 which extends into the lower part of the body 1 is mounted on the end wall 7 of a terminal housing 8, the two ends of the element 6 entering the terminal housing 8 through the end wall 7 and the metal sheath 9 being sealed to the end wall 7 in a fluid-tight manner. A terminal lead (not shown) from one of the ends of the heating element 6 extends through the housing 8 and is connected to a terminal pin 10 carried by the housing 8. A terminal lead 11 from the other end of the heating element is provided with a switch contact 12 which is electrically connectible to a terminal pin 13 carried on the lower part of the handle 5 by way of a U-shaped spring contact 14. The contact 12 and the spring contact 14 form a cut out switch for disconnecting the heating element 6 from an electric supply. The spring contact 14 is engageable by a plunger 15 of insulating material which is connected to a push rod 16 having one end slidably mounted in the base 17 of the housing 8 and which at its opposite end engages a thermally responsive part of a thermally operated device (not shown) accommodated in a pocket carried on the end wall 7 of the housing 8. This thermally operated device is arranged to operate the push rod 16 and thus actuate the plunger 15 so that it moves the spring contact 14 away from the contact 12, should the heating element 6 overheat due to the jug boiling dry or being switched on without any liquid in it. A third terminal pin 18, carried by the housing 8 and arranged to provide an earth connection for the metal sheath 9 projects from the base 17 of the housing 8 parallel to the terminal pins 10 and 13. The housing 8 is secured in an aperture 20 in the body 1 to form a liquid-tight joint, by two screws 21 which pass through aligned holes in a sealing member 22, the body 1 and a further sealing member 23, and screw into threaded holes in the

housing 8. A shroud member 24 of electrically insulating material surrounds the terminal pins 10, 13 and 18 and is secured to the lower part of the handle 5 by a screw 25 which screws into a threaded hole 26 in the handle 5.

The handle 5 is secured to the body 1 by a screw 27 which passes through the wall of the body 1 and screws into a threaded hole 28 in the upper part of the handle, and by a U-shaped bracket 29 which is welded to the body 1 with its two limbs 30 embracing the lower part of the handle 5. The bracket 29 is fastened to the handle 5 by two screws 31 each of which passes through one of the limbs 30 and screws into a threaded hole 32 in the lower part of the handle. The bracket 29 and screws 31 are covered by the upper part of the shroud member 24 when it is secured in position on the handle 5. A bimetallic element 33 is accommodated in a compartment 34 which is defined between the wall of the body 1 and the facing surface of the handle 5. The bimetallic element 33 which is in the form of a strip is mounted on a bracket 35 secured by screws (not shown) to the upper part of the handle 5. A further screw 36 provides for adjustment of the position of the bracket 35 and thus provides adjustment of the position of the bimetallic element 33. An aperture 37 in the wall of the body 1 admits steam from the upper part of the body 1 to a duct 38 which is provided with a row of outlets 39 for directing steam onto the whole length of the bimetallic element 33. A further compartment 41 in the handle 5 accommodates a snap action switch 42 having a movable contact 43 which co-operates with a fixed contact 44 carried by a conductive strip 45 rivetted to the terminal pin 13. The conductive strip 45 is secured to the handle 5 by a screw 46 and a further screw 47 provides for adjustment of the position of the fixed contact 44. The snap action switch 42 comprises a trifurcated resilient blade member 48 (see Figure 5), the centre limb 49 of which carries the movable contact 43, and a bow spring 50 arranged to provide the spring force for the snap action. The trifurcated blade member 48 is secured at its lower end to the handle 5 by a screw 51 and a rivet 52, the latter also affording electrical connection with an electrically conductive strip 53 formed integral with the U-shaped spring contact 14. A cover 54 which affords access to the compartment 41 when the handle is detached from the body 1, carries a spring device 55 operable between two stable positions and arranged to modify the action of the snap action switch 42. The cover 54 also carries a slidably mounted plunger 56 arranged to transmit movement of the bimetallic element 33 to the snap action switch 42. A diaphragm 57 mounted on the

cover 54 prevents steam or moisture in the compartment 34 entering the compartment 41. The spring device 55 is actuated by a push rod 58 slidably mounted in an aperture 59 in the handle 5 and held by the spring device 55 against a cam surface 60 of a control knob 61 which is rotatable between a central position marked 'SIMMER' and either of two circumferentially off-set positions marked 'BOIL'. The cam surface 60 is arranged so that the push rod 58 causes deflection of the spring device 55 to a first position when the control knob 61 is set to the SIMMER position, and permits the spring device 55 to return to a second, non-operative condition, when the control knob 61 is set to either of the two BOIL positions. An arrow 62 of light transmitting material set in the handle 5 and arranged to be illuminated by a lamp 63 accommodated in the handle 5, indicates the position to which the control knob 61 is set. The lamp 63 is connected in series with the heating element 6 and is bridged by the contacts 43 and 44 of the snap action switch 42, so that the lamp is illuminated when contact 43 moves away from contact 44.

When a liquid in the jug is to be heated the terminal pins 10 and 13 are connected to an electric supply by way of a connector and a flexible electric cable (not shown) so that an energising circuit extends from the terminal pin 13 through the conductive strip 45 and the contacts 44 and 43, through the conductive strip 53 and U-shaped spring contact 14 and the contact 12, and then through the heating element 6 to the terminal pin 10. When the liquid in the jug boils, steam at the top of the jug enters the aperture 37 and flows along the duct 38 and through the outlets 39. The steam heats the bimetallic element 33 causing its lower end to engage the plunger 56 and urge it against the resilient member 48 of the snap action switch 42. If the control knob 61 is set to the SIMMER position as shown in Figures 2 and 3 of the drawings, the spring device 55 is set to its first position so that its upper end allows only limited movement of centre limb 49 of the snap action switch and therefore the limb 49 cannot move past the "over-centre" position. Therefore when the bimetallic element 33 urges the plunger 56 against the resilient member 48, the movable contact 43 is moved away from the fixed contact 44 to break the energising circuit of the heating element 6, but the movable contact 43 will again engage the fixed contact 44 to restore the energising circuit when steam ceases to pass into the compartment 34 and the bimetallic element 33 begins to cool down. Thereafter the heating element 6 is energised intermittently so as to allow the contents of the jug to simmer. When the movable contact 43

moves away from the fixed contact 44 the lamp 63 is illuminated to indicate that the liquid in the jug has boiled. If the control knob 61 is set to one of the BOIL positions, the spring device 55 takes up its second position which allows the centre limb 49 of the snap action switch 42 to move past the "over-centre" position when the bimetallic element 33 urges the plunger 56 against the resilient member 48. Therefore once the liquid in the jug has boiled and the steam entering the compartment 34 has caused the bimetallic element 33 to urge the centre limb 49 of the snap action switch 42 past the over-centre position, the movable contact 43 is moved away from the fixed contact 44 to break the energising circuit which cannot be restored until the bimetallic element 33 has cooled down and the control knob 61 has been turned through the SIMMER position. If the heating element 6 overheats due to the jug boiling dry or being switched on without any liquid in it, the thermally operated device accommodated in the housing 8 operates and moves the push rod 16 which disconnects the energising circuit of the heating element 6 by causing the plunger 15 to engage the spring contact 14 and move it away from contact 12. When the heating element 6 has cooled down the thermally operated device may be reset by pressing the push rod 16 whereupon the plunger 15 moves away from spring contact 14 which then engages contact 12 and thus restores the energising circuit of the heating element.

The handle 5 may be detached from the jug, without disturbing the terminal housing 8 or the heating element 6, by first unscrewing and removing the screw 25 which allows the shroud member 24 to be removed revealing screws 31. Removal of screws 31 and screw 27 permits the handle 5 to be removed from the jug as a unit. When the handle 5 is detached from the jug the bimetallic element 33 is accessible for repair or replacement and the spring device 55 and the snap action switch 42 are accessible when the cover 54 has been removed from the handle. The terminal housing 8 with the heating element 6 may be removed from the jug, without disturbing the handle, by first detaching the shroud member 24 and then unscrewing and removing the two screws 21. In practice it is envisaged that the handle 5 complete with bimetallic element 33, spring device 55 and snap action switch 42 would be available as a replacement unit as would the terminal housing 8 complete with a thermally operated device and sheathed heating element 6. In the event of a fault developing in the heating element 6 or any part of its associated electrical circuit, the jug could quickly be made serviceable by replacing one or both these units as

required. This is advantageous in that a screwdriver is the only tool necessary to effect such replacement and in that the person effecting the repair does not need to be skilled in the adjustment of bimetallic elements and switching contacts, since the replacement units would be accurately adjusted when they are manufactured. Moreover, the removal of either the handle 5 or the terminal housing 8 does not involve the manual disconnection of circuit conductors such as might lead to mistakes when they have to be replaced. As will be appreciated from reference to Figure 4, the removal of either the housing 8 or the handle 5 automatically disconnects the spring contact 14 from the contact 12 and thus disconnects the circuit connection between the electrical components in the handle 5 and those in the housing 8. This circuit connection is automatically restored by the spring contact 14 and contact 12 when the handle 5 and the housing 8 are again secured in position on the jug.

Although the invention has been described when applied to a jug, the invention is equally applicable to other electrically heated domestic vessels such as kettles, pans and percolators. For example, when the invention is applied to a kettle, the handle 5 may be secured to a substantially horizontally disposed upper wall of the kettle.

In the arrangement shown in Figure 7, the duct 38 is dispensed with and steam from the upper wall of the body 1 enters the compartment 34 through an aperture 65 in the wall of the body 1. A baffle plate 66 secured by the screw 27, which secures the handle 5 to the body 1, prevents water entering the aperture 65. The bimetallic element 33, which is substantially U-shaped, has one limb 67 secured to a bracket 68 which is mounted on the upper part of the handle 5 by screws not shown. A further screw 69 provides for adjustment of the position of the bracket 68 and thus provides adjustment of the position of the bimetallic element 33. The other limb 70 of the bimetallic element 33 engages the plunger 56 which transmits movement of the bimetallic element 33 to the snap action switch 42 as previously described. In an alternative arrangement a tube 71, shown in broken line, may be provided to convey steam from the upper part of the vessel to the compartment 34.

WHAT WE CLAIM IS:—

1. An electrically heated domestic vessel comprising a first housing mounted on a wall of the vessel and supporting an electric immersion heater so that it extends into the vessel, this first housing carrying a first thermally operated device arranged to operate if the vessel boils dry or is switched on without any liquid in it, a second housing

mounted on a wall of the vessel and accommodating a second thermally operated device arranged to be operated by steam produced when liquid in the vessel boils and when operated to actuate switch contacts controlling an energising circuit of the immersion heater, and co-operating electrical conductors carried by the two housings and arranged to make electrical contact and automatically establish an electrical circuit between electrical components supported by or accommodated in the two housings when the two housings are attached to the vessel, the first thermally operated device being arranged to break the electrical contact between the co-operating conductors when it operates.

2. A vessel as claimed in claim 1, wherein the switch contacts actuated by the second thermally operated device can be set to a first condition such that the energising circuit of the immersion heater is restored automatically when the liquid in the vessel stops boiling and the second thermally operated device cools down.

3. A vessel as claimed in claim 1 or claim 2, wherein the switch contacts actuated by the second thermally operated device can be set to a second condition such that once the energising circuit of the immersion heater has been broken by the switch contacts it cannot be restored until the switch contacts have been reset manually.

4. A vessel as claimed in claim 2 or claim 3, wherein the switch contacts are set to the first condition and/or the second condition by a control member which controls a spring device arranged to modify the action of the switch contacts.

5. A vessel as claimed in claim 4, wherein the control member operates a cam which actuates the spring device.

6. A vessel as claimed in any preceding claim, wherein each of the housings is arranged so that it can be detached from the vessel without disturbing the other housing.

7. A vessel as claimed in any preceding claim, wherein steam from the upper part of the vessel is conveyed to a thermally responsive part of the second thermally operated device through an aperture in the wall of the vessel.

8. A vessel as claimed in claim 7, wherein a duct communicating with the aperture is provided in the wall of the vessel and is formed with a plurality of outlets arranged so that steam is directed on to substantially the whole of the thermally responsive part.

9. A vessel as claimed in any one of claims 1 to 6, wherein steam from the upper part of the vessel is conveyed to a thermally responsive part of the second thermally operated device by a tube.

10. A vessel as claimed in any preceding claim, wherein each housing carries a

terminal pin through which energising current can be supplied to the immersion heater, and parts of the two housings carrying the terminal pins co-operate with a shroud member carried by the second housing and surrounding the terminal pins to provide a terminal pin assembly for receiving a connector for connecting the vessel to an electrical supply.

11. A vessel as claimed in claim 10, wherein the shroud member is secured to the second housing by screw means and has to be removed from the vessel before the first housing can be detached from the vessel.

12. A vessel as claimed in claim 10 or claim 11, wherein one end of the immersion heater is electrically connected to a first terminal pin carried by the first housing, and the other end of the immersion heater is electrically connected to the co-operating conductor carried by the first housing, the co-operating conductor carried by the second housing being electrically connectible to a second terminal pin carried by the second housing.

13. A vessel as claimed in claim 12, wherein the co-operating conductor carried by the second housing is a U-shaped resilient member.

14. A vessel as claimed in claim 12 or claim 13, wherein the first housing includes a plunger actuated by the first thermally operated device and arranged to move the conductor carried by the second housing away from the conductor carried by the first housing should the immersion heater over-heat due to the vessel boiling dry or being switched on without any liquid in it.

15. A vessel as claimed in any one of claims 12 to 14, wherein the first housing carries a third terminal pin arranged to provide an earth connection for a metal sheath of the immersion heater.

16. A vessel as claimed in any preceding claim, wherein the first housing includes a push rod manually operable to reset the first thermally operated device when it has cooled down after it has operated, thereby allowing the conductor carried by the second housing to re-establish electrical contact with the conductor carried by the first housing.

17. A vessel as claimed in any preceding claim, wherein the second housing is arranged to co-operate with the wall of the vessel on which it is mounted to define a compartment in which a thermally responsive part of the second thermally operated device is housed.

18. A vessel as claimed in any preceding claim, wherein the second housing is secured to the wall of the vessel by screw means which pass through the wall and screw into threaded portions of an upper

part of the second housing, and by a U-shaped bracket secured to the vessel with its two limbs embracing a part of the second housing and secured thereto by screw means.

- 5 19. A vessel as claimed in any preceding claim wherein the first housing is secured in an aperture in the wall of the vessel to form a liquid tight joint by screw means which
10 pass through aligned holes in the wall of the vessel and sealing means and screw into threaded holes in the first housing.

- 15 20. A vessel as claimed in any preceding claim, wherein the second housing forms a handle for carrying the vessel.

21. A vessel as claimed in claim 20,

wherein the vessel is a jug and the second housing is secured to a substantially vertically disposed wall of the jug.

22. A vessel as claimed in claim 20, wherein the vessel is a kettle and the second housing is secured to a substantially horizontally disposed wall of the kettle. 20

23. An electrically heated domestic vessel constructed substantially as shown in, and arranged to operate substantially as hereinbefore described with reference to the drawings filed with the Provisional Specification. 25

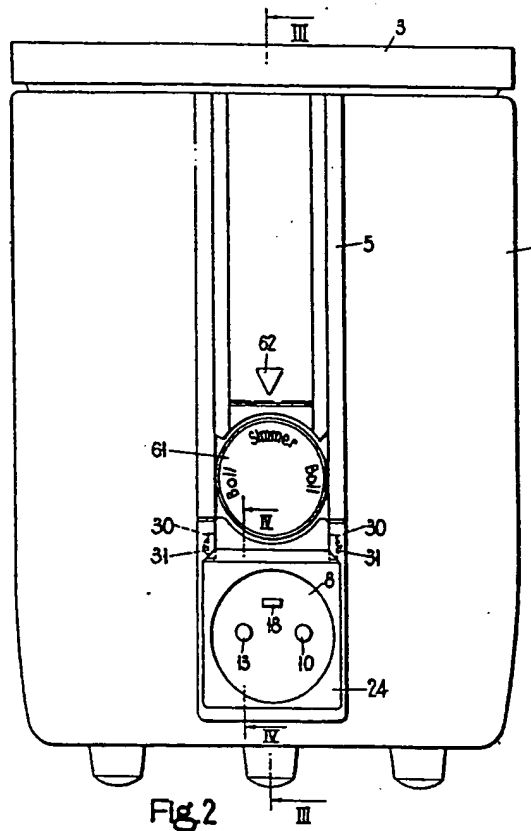
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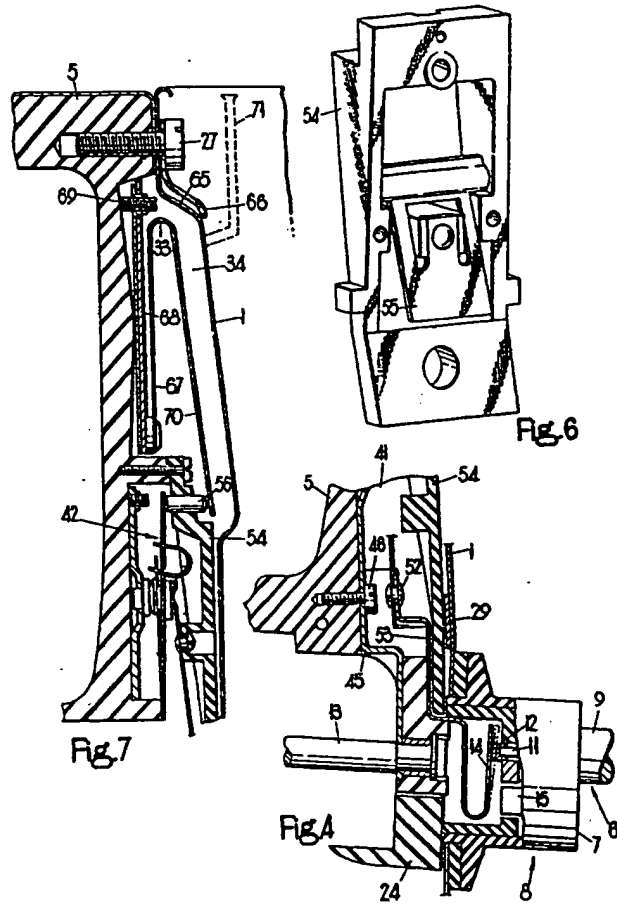
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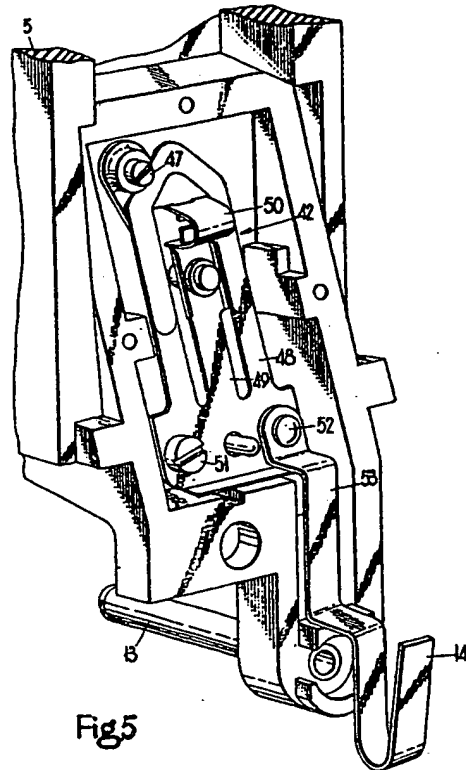


Fig 5